CLAIMS

We claim:

1. A thermal history sensor for estimating the remaining useful lifetime of a component exposed to temperature above 400 kelvin, comprising a plurality of glass ceramic substrates positioned adjacent to the component, wherein said glass ceramic substrates have different compositions whereby said glass ceramic substrates respond to a set of thermal stressors with different changes in opacity.

2. The thermal history sensor of claim 1, further comprising an attachment means for securing said thermal history sensor to the component.

3. The thermal history sensor of claim 1, further comprising a reflective surface, positioned under said glass ceramic substrates, for reflecting a beam of light transmitted through said glass ceramic substrates back through same said glass ceramic substrates.

4. The thermal history sensor of claim 3, further comprising a refractory material adjacent to said reflective surface.

5. The thermal history sensor of claim 4, wherein said refractory material comprises sapphire.

6. The thermal history sensor of claim 4, wherein said reflective surface is a coating applied to said refractory material.

7. The thermal history sensor of claim 1, wherein said glass ceramic substrates are aligned in a predetermined array within the same plane.

8. The thermal history sensor of claim 1, wherein said thermal history sensor comprises at least 4 and no more than 36 of said glass ceramic substrates.

9. A thermal history sensor for estimating the remaining useful lifetime of a component, comprising:

a plurality of glass ceramic substrates positioned adjacent to the component, wherein each said glass ceramic substrate has a composition different from every other said glass ceramic substrate;

a reflective surface positioned under said glass ceramic substrates for reflecting a beam of light transmitted through said glass ceramic substrates back through same said glass ceramic substrates; and

a refractory material positioned adjacent to said reflective surface.

10. The thermal history sensor of claim 9, wherein said reflective surface comprises platinum.

11. The thermal history sensor of claim 9, wherein said thermal history sensor comprises at least 3 and not more than 36 said glass ceramic substrates aligned in a predetermined array within the same plane.

12. The thermal history sensor of claim 9, wherein said refractory material comprises an attachment means for securing said thermal history sensor to the component.

13. A method for obtaining the thermal history of a component, comprising:

positioning at least one thermal history sensor adjacent to the component, wherein said thermal history sensor comprises a plurality of glass ceramic substrates having different compositions;

exposing the component and said thermal history sensor to a set of thermal stressors; and

measuring the percentages of opacity of said glass ceramic substrates.

14. The method for obtaining the thermal history of a component according to claim 13, further comprising the step of positioning a reflective surface adjacent to said glass ceramic substrates wherein a beam of light transmitted at specific angles through said glass ceramic substrates is reflected back through said same glass ceramic substrates.

15. The method for obtaining the thermal history of a component according to claim 13, further comprising the step of positioning a refractory material adjacent to said reflective surface.

16. The method for obtaining the thermal history of a component according to claim 13, further comprising the step of comparing the percentages of opacity of said glass ceramic substrates to baseline data whereby information about the expected remaining useful lifetime of the component is obtained.

17. The method for obtaining the thermal history of a component according to claim 13, wherein the step of positioning said thermal history sensor adjacent to the component comprises the step of attaching said thermal history sensor to the component.

18. The method for obtaining the thermal history of a component according to claim 13, wherein the step of positioning said thermal history sensor adjacent to the component comprises the step of aligning said plurality of glass ceramic substrates into a predetermined array within the same plane.

19. The method for obtaining the thermal history of a component according to claim 13, further comprising the step of obtaining a thermal history fingerprint from said percentages of opacity of said glass ceramic substrates.